

DRAWINGS ATTACHED

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(54) FILTRATION

- (71) We, ROSE, DOWNS & THOMPSON LIMITED, a British Company of Old Foundry, Cannon Street, Kingston-upon-Hull, Yorkshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 This invention relates to filtration. Some mixtures of solids and liquids are difficult to filter, because the solids compress against the filter material to form an impervious cake which not only prevents washing of the solids to remove wanted liquid from within the interstices of the solids, but also tends to block the filter. The use of a mechanical pressing device to aid the filtering action merely compacts the solids further into an impervious mass and in addition may cause local high pressure spots on the filter resulting in breakthrough of solids through the filter.
- 25 One aspect of the present invention resides in a method of separating by filtration a mixture of liquid and solids, in which the mixture is passed into a filtration chamber at a point below a filter medium, through which upwardly flowing liquid must pass, a displacement liquid having a specific gravity greater than those of the liquid and the solids of the mixture is directed into the chamber below the filter medium, so that the solids are caused to rise against the underside of the filter medium, and the supply of displacement liquid is continued to cause the passage through the filter medium of the mixture liquid and displacement liquid, the latter washing the solids retained against the filter medium and removing therefrom any adhering mixture liquid. When the mixture liquid has been separated from the solids in this way, the flow of displacement liquid may be terminated and the solids removed from the
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filter medium by passage of a fluid in the opposite direction.

When the solids of the mixture are readily compressible, the method of the invention ensures that those solids are not so heavily compressed as to form an impermeable cake which is liable to block the filter medium. Instead the displacement liquid gently presses the solids against the filter medium, thus allowing the passage of the mixture liquid and displacement liquid through the filter medium.

Preferably the displacement liquid is substantially immiscible with the mixture liquid and must not of course be a solvent for the solids.

The invention will be more readily understood by way of example from the following description of filtration apparatus and a method of filtering in accordance therewith, reference being made to the drawing accompanying the provisional specification which drawing schematically illustrates a filter chamber.

In the drawing, the filter chamber 12 has a horizontal filter medium 13 located high up in the chamber. The material of the filter medium is chosen according to the solids to be filtered and may be a wire mesh, cloth, wedge wire or the like.

The filter chamber has a series of inlets and outlets:—
 an inlet 14 for displacement liquid,
 an inlet 15 at a higher level, for introduction of a slurry to be filtered,
 an outlet 16 for the removal of displacement liquid,
 an outlet 17 at the bottom of the chamber for the removal of the solid contact of the slurry,
 an outlet 18 at a height above the filter 13 for the discharge of displacement liquid and the mixture liquid, and
 an inlet 20 also above the level of the filter 13 for the introduction of fluid for

discharging the filtered solids.

The slurry to be filtered is introduced through the inlet 15. Where the slurry contains a relatively high proportion of solid content the space between the filter medium 13 and the bottom of the chamber 12 is merely filled with the slurry. But, where the slurry has a small solid content which sinks in the liquid content, slurry may be continuously supplied to the chamber until a thick layer of the solids is formed in the bottom of the chamber, the liquid content passing upwards through the filter medium and out through the outlet 18. When the chamber has been charged in the first case, or when the thick layer has been formed in the second case, the supply of slurry is cut off and a displacement liquid is introduced through inlet 14, the displacement liquid being immiscible with the slurry liquid and having a higher density than that of either the solid or liquid content of the slurry. The displacement liquid displaces the layer of solids which floats off the bottom of the chamber and eventually comes to rest on the underside of the filter 13 as a filter cake. The rate of introduction of the displacement liquid through inlet 14 is now increased to cause the displacement liquid to pass between the particles making up the filter cake at a high velocity, so causing them to be washed clean of adherent slurry liquid. A pressure drop is developed across the thickness of the filter cake which pressure drop is uniformly applied across the cross-section of the cake and which causes the cake to be gently compacted, thereby narrowing the spaces between the solid particles and so increasing the velocity of the displacement liquid and improving the efficiency of its washing action. The slurry liquid and displacement liquid leave through outlet 18 and are separated, for example in settling tanks where the specific gravity difference of the two liquids causes their rapid separation. Lastly, residual displacement liquid is drained from the chamber through outlet 16 and fluid is introduced through inlet 20 to flush the filter 13 and to discharge the solids through the outlet 17 to a separating tank for separation of the solids.

It will be appreciated that the filter system as described operates on a batch principle. For continuous filtering action, a battery of filter chambers similar to that described is provided, with the supply of slurry being connected in turn to the individual chambers and then treated as described.

In patent specification No. 1208175, there is described the removal of waxes from oils by selective crystallisation. One problem associated with the process of that specification is the removal of the crystallised

waxes from the mother liquid after discharge from the section 22 of the column shown in the drawing accompanying that specification, because the temperature of the slurry of crystallised wax and oil must be kept constant since, otherwise, on warming the wax tends to dissolve in the oil and on cooling to separate out on all cold surfaces. Furthermore, the wax crystals are bulky and very readily compressed to an impervious cake which tends to block normal filters. The filter apparatus and method described above is well adapted to separate the slurry of crystals and oil.

When the slurry to be separated consists of crystallised wax and oil as from the process of the before-mentioned specification, the filter is first cooled to the temperature of the slurry, by passing cold liquid through the filter chamber, by introducing it through inlet 14 and discharging it through outlet 18. The cooling liquid is preferably the liquid circulated through the apparatus of the before-mentioned specification by pump 20 and consists of water saturated with solvent. When the operating temperature has been achieved, the cooling liquid is drained through outlet 16.

The slurry of crystals and oil is introduced through inlet 14 until a thick bed of the crystals has been formed, when further introduction of the slurry is stopped. The displacement liquid, which is again water saturated with solvent, is as before introduced to raise the crystal bed to the underside of the filter 13 and then to wash out the mother liquid. When washing is completed, the displacement liquid is drained through outlet 16 and the displacement liquid in vapour phase is supplied through inlet 20 to melt the crystals on the underside of the filter 13 and to wash the melted wax out of the chamber 12, the condensate and hot wax leaving through the outlet 17. The filter chamber may then be cooled as before and then used immediately for the next cycle of filtration.

WHAT WE CLAIM IS:—

1. A method of separating by filtration a mixture of liquid and solids, in which the mixture is passed into a filtration chamber at a point below a filter medium, through which upwardly flowing liquid must pass, a displacement liquid having a specific gravity greater than those of the liquid and the solids of the mixture is directed into the chamber below the filter medium, to cause the solids to rise against the underside of the filter medium, and the supply of displacement liquid is continued to cause the passage through the filter medium of the mixture liquid and displacement liquid, the latter washing the solids retained against the filter medium

- and removing therefrom any adhering mixture liquid.
2. A separating method according to claim 1 in which, after the mixture liquid has been driven through the filter medium, a fluid is passed through the filter medium in the opposite direction in order to remove the solids from the filter medium.
3. A separating method according to claim 2 in which the fluid is the gaseous form of the displacement liquid.
4. A separating method according to any one of the preceding claims in which there is more than one filtration chamber, each with its filter medium, and the supply of the mixture is connected in turn to the chambers.
5. A separating method according to any one of the preceding claims in which the liquid of the mixture is an oil and the solids are waxes which are crystallised from the oil.
6. A separating method according to claim 5 in which the waxes are crystallised by cooling the mixture below a prescribed temperature, and the chamber is similarly cooled prior to introduction of the mixture.
7. A method of separating by filtration, substantially as described herein with reference to the accompanying drawing.
8. Crystallised waxes derived by the method according to any of claims 5, 6 or 7.
9. Apparatus for performing the method of any of the preceding claims 1 to 7, substantially as described herein with reference to the drawing accompanying the provisional specification.
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PROVISIONAL SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale.*

